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**The Value of Online Information Privacy:
An Empirical Investigation**

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Executive Summary

Concern over online information privacy is widespread and rising. However, prior research is silent about the value of information privacy in the presence of potential benefits from sharing personally identifiable information. Analyzing individuals' trade-offs between the benefits and costs of providing personal information to websites revealed that benefits – monetary reward and future convenience – significantly affect individuals' preferences over websites with differing privacy policies. Quantifying the value of website privacy protection revealed that among U.S. subjects, protection against errors, improper access, and secondary use of personal information is worth US\$30.49 – 44.62. Finally, three distinct segments of Internet consumers were determined – privacy guardians, information sellers, and convenience seekers.



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1. Introduction

Privacy has been identified to be a major, if not the most critical, impediment to e-commerce: “In our view, the single, overwhelming barrier to rapid growth of e-commerce is a lack of consumer trust that consumer protection and privacy laws will apply in cyberspace. Consumers ... worry, deservedly, that supposedly legitimate companies will take advantage of them by invading their privacy to capture information about them for marketing and other secondary purposes without their informed consent” (U.S. Public Interest Research Group 2000).

Even before the advent of e-commerce, there was broad concern about collection of personal information in various contexts, including employment, retailing and direct marketing, and government. These concerns prompted government action. In 1974, the U.S. Congress passed the Privacy Act to regulate government collection and use of personal information.¹ In 1980, the Organization for Economic Co-operation and Development published guidelines for the collection and use of personal information by government and private organizations (OECD 1980). Further, in 1995, the European Union adopted a data protection directive that regulates information within and beyond the Union (European Union 1995). The directive disallows transfer of information to other countries that do not provide adequate protection.

Rapid improvements in computing technologies and the advent of e-commerce have amplified public concern about privacy, especially on electronic networks. With every website visit, a browser leaves an electronic trace which can later be retrieved and analyzed. Combined with technology to store identifying information (cookies), website operators can profile browsers to an unprecedented degree and subsequently merge these profiles with other demographic data. Such an enriched data set can then be used by the company or sold to other parties.² This information could benefit the customer by more precisely identifying her need. However, it could also be used to her detriment. For example, Amazon.com was suspected of engaging in differential pricing based on prior shopping information and other customer

¹ Specifically, the Privacy Act of 1974 prohibits unauthorized disclosures of records and gives individuals the right to review records about themselves to check whether records have been disclosed and to request corrections or amendments.

² New York Times, “Giving the Web a Memory Cost Its Users Privacy,” September 4, 2001.

demographics for the sales of DVDs.³ Westin (2001) concludes: “There has been a well-documented transformation in consumer privacy attitudes over the past decade, moving concerns from a modest matter for a minority of consumers in the 1980s to an issue of high intensity expressed by more than three-fourth of American consumers in 2001”.

Despite the passage of new legislation, including the 1998 Children’s Online Privacy Protection Act, which regulates the online collection and use of children’s personal information, there continues to be public pressure for increased regulation. Over fifty bills to regulate online privacy were introduced in the first session of the 107th Congress. Industry, however, is resisting the proposals to tighten regulation. The national cost of complying with these legislative proposals has been estimated to be US\$9-36 billion (Hahn 2001). For just catalog and Internet clothing retailers, a study sponsored by the Direct Marketing Association estimated that opt-in restrictions to use of demographic information by third parties would raise costs by US\$1 billion (Turner 2001).

The conflict between privacy advocates and industry motivates our research objective: Exactly how much do individuals perceive to be the cost of releasing personal information online? The real policy issue is not whether consumers value online privacy. It is obvious that people value online privacy. What is not known is how much people value online privacy and the extent to which people differ in their valuations. Despite tremendous debate and policy interest, there has, to date, been no research into this question (Hahn 2001). Indeed, it has been conjectured that “measuring the value of consumer privacy may prove to be intractable” (Ward 2001).

Businesses need to know the value of privacy in deciding whether to invest in privacy seals and what incentives to offer consumers for their personal information. Governments need this information to decide on public policy towards information privacy. For instance, Laudon (1996) and Varian (1997) have proposed to regulate privacy through markets in personal information. But the economic viability of such markets depends on individuals’ perceived value of privacy.

In this study, we applied conjoint analysis, which is the standard way of measuring consumer trade-offs (Green and Srinivasan 1990; Wittink and Cattin 1989), to U.S. and

³ Amazon has subsequently apologized for charging different prices and refunded an average of \$3.10 to each of 6,896 customers who bought a DVD. These consumers paid between 25-66 percent more than the lowest available price. While it has been

Singapore subjects' rankings of alternative combinations of benefits and privacy protection in an online setting. The benefits were monetary reward and future convenience, while the privacy protection applies to errors in storing or processing personal information, unauthorized secondary use of information, and improper access to information.⁴ This allows us to make the following contributions:

First, the conjoint analysis showed that the benefits had a significant effect on our subjects' preferences. Second, by comparing the value of protection on the three privacy concerns with the value of monetary reward, we provide the first estimates of the monetary value of privacy protection in the United States. Last, by applying cluster analysis to the subjects' marginal rankings of the various benefits and concerns, we found that our subjects could be categorized into three distinct segments – privacy guardians, information sellers, and convenience seekers. The majority of subjects were relatively sensitive to online information privacy concerns (“privacy guardians”). By contrast, a smaller proportion was relatively willing to provide information in exchange for money (“information sellers”), and an even smaller proportion was relatively willing to provide information in exchange for convenience (“convenience seekers”).

All of the preceding results were robust in the sense that they held in both the U.S. and Singapore samples. Our results contribute directly to the public policy debate over whether online privacy protection is worth its cost to industry. They also inform businesses whether to invest in privacy seals and what incentives to offer consumers for their personal information.

The remainder of this paper is organized as follows. We provide an overview of the relevant literature and our research questions in Section 2. The experimental procedure is explained in Section 3. Section 4 describes the results of the conjoint analysis and estimates the dollar value of privacy protection. Section 5 reports the results of the cluster analysis. Section 6 discusses implications for public policy and business strategy. Section 7 concludes with limitations and directions for future research.

speculated that Amazon engaged in price discrimination, Amazon claimed that these were ‘random’ tests. (http://www.internetnews.com/ec-news/article.php/4_471541, September 28, 2000).

2. Theory and Hypotheses

Information privacy has been defined as the individual's ability to control the collection and use of personal information (Westin 1967; Stone and Stone 1990). Research in consumer psychology suggests that individuals seek privacy to maintain self-identity, establish personal boundaries, and avoid unwanted disclosure and intrusion (Goodwin 1991, 1992). In many experimental and organizational settings, people are found to perceive privacy invasions when they are not granted sufficient control on the solicitation, storage, use and disclosure of various types of personal information (see, e.g., Eddy et al. 1999; Tolchinsky et al. 1981; Woodman et al. 1982). Such perception may deter them from taking part in transactions that involve personal information solicitation (Culnan 1993; Stone et al. 1983).

Consumer research suggests that individuals face a degree of risk when they enter into marketing transactions, and their perceived risk may significantly affect their extent of information search and purchase decisions (Cox and Rich 1964). Generally, perceived risk encompasses both the uncertainty and adverse consequences of taking part in a transaction (Dowling and Staelin 1994). Advances in network and telecommunications technologies have fostered the growth of electronic commerce, which has added a new information dimension to marketing transactions. Increasingly, consumer information is acquired, exchanged, and used by online merchants. This has expanded the risk of consumers – other than the basic products (or services), they now face an additional uncertainty regarding how their personal information is handled. Information privacy has been found to be of utmost concern to consumers in contemporary marketing exchanges (Culnan and Armstrong 1999; Hoffman et al. 1999; Phelps et al. 2000).

One perspective through which the information privacy context of an Internet relationship between a consumer and a firm can be discussed is Social Exchange Theory (SET). In its most general form, social exchange theory proposes that people review and weigh their relationships in terms of costs and rewards. These costs and rewards are specific to a person and are used to guide behavior (Thibaut and Kelley 1959; Homans 1961; Blau 1964). This notion has found widespread application in diverse areas; social exchange theory has been used to understand marketing transactions (Alderson and Martin 1965; Bagozzi 1975), to predict the

⁴ The objective of this research certainly fits within Wittink's (2001) "Encapsulation Model" in which business school research

perception of service level obtained from a government agency (Guttek 1999) and to analyze the reciprocity of venture capitalists to invite other venture capitalists to join in a continued funding of a start-up (Jan Piskorski). Specifically, in the context of online marketing, Chellappa and Sin (2002) propose several hypotheses based on social exchange theory.

Invoking social exchange theory to analyze the Internet relationship, we first have to establish the costs and rewards to submitting private information to a firm. Regarding the costs, we identified the four concern dimensions previously established by Smith et al. (1996) – collection, error, unauthorized secondary use, and improper access. Collection refers to the concern that “extensive amounts of personally identifiable data are being collected and stored in databases”; error refers to the concern that “protections against deliberate and accidental errors in personal data are inadequate”; unauthorized secondary use refers to the concern that “information is collected for one purpose but is used for another, secondary purpose”; improper access refers to the concern that “data about individuals are readily available to people not properly authorized to view or work with this data” (Smith et al. 1996, page 172, Table 2). These dimensions were further validated by Stewart and Segars (2002).

In online transactions, firms seek to reduce these costs through notices and protections which are often provided in the form of a detailed privacy statement. Because of the extra risk associated with the use of personal information, consumers value informed notices of how their information is handled, and they prefer fair information procedures and privacy protection (Culnan and Armstrong 1999; Hoffman et al. 1999). Hence social exchange theory would suggest that consumers prefer websites that reduce these costs. In addition, the expectancy theory-based model of privacy suggests that individuals seek to minimize negatively valued outcomes, which include physical and psychological harms due to the misuse of personal information. Further, individuals’ cognition of the desirability of the expected outcome due to disclosure is a direct, positive function of procedural factors related to information handling (Stone and Stone 1990). Therefore, our first hypothesis is formulated as:

Hypothesis H1: Individuals value information privacy protection in online transactions that involve personal information solicitation; a website that provides a higher level of protection will be preferred to one that provides less protection.

Besides information privacy protection, individuals' preference toward a particular website may also be affected by extrinsic, positive reinforcements. The resource exchange theory characterizes six categories of interpersonal resources: love, status, information, money, goods and services, and it is well demonstrated that people are willing to trade one resource for another (Foa 1971; Donnenwerth and Foa 1974). Prior research has shown that this resource framework is quite general, and it can be applied to analyze different types of marketing transactions that involve interpersonal relationships and resource exchanges (Brinberg and Wood 1983; Hirschman 1987).

On the Internet, many websites provide monetary reward or exclusive, convenient services that help reduce transaction time to consumers who disclose certain personal information.⁵ Both money and service are primary elements in Foa's (1971) theory, and they may act as positive incentives and resources for online firms to exchange for consumer information. Further, because privacy protection represents another type of service provided by online firms, the resource exchange theory predicts that people may be willing to forgo privacy protection in return for other resources (i.e., money or convenient services). Indeed, anecdotal evidence has shown that people are willing to disclose personal information for gifts and catalogs (Oberndorf 1999; Russell 1989), and even a \$100 drawing (Jupiter Media Metrix 2002). The human capital model in economics also treats time as a primary resource to produce household activities (Becker 1965; Leclerc et al. 1995; Ratchford 2001). This implies that people may value services provided by websites that increase convenience and help save time, which can then be used for other consumption activities.

The proposition that individuals value positive reinforcements when deciding whether to provide information to websites is also consistent with social exchange theories. Specifically, the social exchange framework of human behavior posits that people tend to perform actions that generate outcomes which, based on their past experience and personal interest, are rewarding to them (Blau 1964; Emerson 1972a, 1972b; Homans 1961). The more rewarding is a particular outcome, the higher the probability that people will perform the associated action.

Because money and convenient service are both useful resources that most people find rewarding (Foa 1971), the social exchange theory suggests that people have a higher tendency to

⁵ For instance, it is common for websites to offer shopping vouchers or discount coupons to first-time consumers who register as members; Amazon's one-click shopping facilitates quicker and easier transactions for customers who have previously provided personal information, such as delivery address and credit card profile.

enter into an exchange relationship with websites which provide more monetary reward or time-saving convenient services. Synthesizing the above theoretical arguments, our next hypotheses are posited as:

Hypothesis H2a: Individuals value positive reinforcements, exemplified by *monetary reward*, in online transactions that involve personal information solicitation; a website that provides *higher levels of money* will be preferred to one that provides less money.

Hypothesis H2b: Individuals value positive reinforcements, exemplified by *time-saving services*, in online transactions that involve personal information solicitation; a website that provides *higher levels of time-saving services* will be preferred to one that provides less time-saving.

Note that H1, H2a and H2b describe basic individual preferences, and they may apply to general behavioral decisions, such as participation into online activities, information disclosure, or selection of websites for transactions. In particular, when individuals are presented with multiple websites that differ in terms of privacy protection or the provision of positive reinforcements, they may tradeoff the value that they attach to each of these dimensions.

Theoretical models of privacy have suggested that individuals perform a privacy calculus to assess the cost and benefit of providing personal information (Laufer and Wolfe 1977; Stone and Stone 1990). In the online context, privacy cost consists of consumers' perceived risk of information provision (cf. H1), whereas benefit can be any monetary rewards or services that consumers receive from websites (cf. H2a, H2b). Such a cost-benefit tradeoff calculus is coherent with Foa's (1971) resource exchange hypothesis, as consumers may forgo privacy protection (a service resource) to acquire more money or services. Empirically, research has found that people often make tradeoff decisions involving money and time (Leclerc et al. 1995). In the context of direct mail participation, Milne and Gordon (1993) exposed subjects to a trade-off between compensation, targeting, volume, and permission, thereby making perceptions about negative consequences of revealing private information implicit. In their study, monetary compensation received the highest weight. As we illustrate later, a conjoint experiment allows us to test H1, H2a and H2b, to explore the extent of such cost-benefit privacy tradeoff explicitly, and to quantify the monetary value of different privacy protections.

Finally, the social exchange theory posits that individuals' choice of actions (and hence their preferences toward alternative stimuli) are influenced by their personal experience; the more frequently a person was rewarded by a particular stimulus in the past, the more likely she

would be to perform an action that leads to the stimulus (Emerson 1972a; Homans 1961). Also, the extent of privacy calculus posited by Laufer and Wolfe (1977) depends on personal and environmental characteristics, and Stone and Stone's (1990) expectancy theory-driven privacy model includes individual and social factors such as personality and previous learning. In accordance with these models, individuals' preferences toward privacy protection and positive reinforcement may be shaped by their personal characteristics. In the context of information privacy, these theories posit that individuals may vary in their judgments towards online privacy. In as much as expectations about rewards and costs across individuals are similar, groups may be identified. For example, past opinion surveys have divided the U.S. population into a majority of "privacy pragmatists" and minorities of "privacy fundamentalists" and "privacy unconcerned" (Westin 2001). In this research, other than testing the hypotheses and assessing privacy tradeoff, we use a variety of personal characteristics as predictors to verify whether such a categorization is appropriate, and whether individuals' attitudes toward privacy can be systematically predicted.

3. Experimental Procedure

To address our primary set of research questions, we employed the technique of conjoint analysis. This technique presents test subjects with a set of alternatives (stimuli). Each stimulus consists of particular levels of various dimensions. The subject is asked to rank the stimuli according to her own preferences. Conjoint analysis assumes that the individual's ranking of each stimulus can be decomposed into the sum of contributions from the multiple dimensions. For each dimension, the contribution is the part-worth multiplied by the level of that dimension. Essentially, the part-worth is the marginal utility of the dimension in the individual's ranking of the conjoint stimuli.

To keep the conjoint tasks to a manageable size, Green and Srinivasan (1990) recommend that the number of attributes be limited to six or fewer. Following Green and Krieger (1991), we conducted focus groups prior to the conjoint study. Specifically, we conducted three focus group discussions with upper-division undergraduate and graduate students in the United States and Singapore to identify the key benefits that they expected from registration with websites and suitable attribute levels. The focus groups suggested that individuals clearly value direct monetary savings. In addition, they also identified convenience

as another important benefit of providing personal information to a website. The focus groups identified two sources of convenience benefits – the explicit time saving per session and the expected visit frequency to the website. Accordingly, we operationalized convenience by “expected visit frequency/total time savings” in our conjoint experiment.⁶

As mentioned before, we considered the four concern dimensions identified by Smith et al. (1996) – collection, error, unauthorized secondary use, and improper access – as the costs of privacy. For our purpose, collection is a necessary antecedent to the three other dimensions. Error, unauthorized secondary use and improper access of information can not happen without ex ante collection of personal information. Further, individuals’ concerns on the other three dimensions are a direct function of the amount of information collected – the more information a website collects, the higher should be the concerns with error, unauthorized secondary use, and improper access of information. Therefore, it would not be appropriate to manipulate the collection of information and let subjects assess the tradeoffs between collection and other concern/benefit dimensions. Accordingly, in our conjoint analysis, we controlled for the collection of information and manipulated the other three concern dimensions.

Taken together, our conjoint study assessed trade-offs among five dimensions – two benefits and three privacy concerns. We created three treatment levels each of monetary reward (\$5, \$10 and \$20) and visit frequency/time savings (monthly, weekly and daily).⁷ The benefit levels were motivated by the focus groups. The three concerns (error, unauthorized secondary use and improper access of information) were manipulated by the presence (or absence) of proper information handling and access procedures.

Based on these five dimensions and their treatment levels, there were a maximum of $3 \times 3 \times 2 \times 2 \times 2 = 72$ conjoint stimuli. To avoid asking subjects to rank too many alternatives, we selected 18 stimuli based on an optimal orthogonal design (Addelman 1962). For example, one particular stimulus was a website that provided a \$5 monetary reward in return for personal information and which the subject visited once a month with a total time savings of 24 minutes per year. Further, the website had no error correction procedure, no policies to prevent

⁶ The subjects were told during the experiments that if they expected to visit the website daily, their average time saving over the year would be 8 hours and 20 minutes (assuming an average saving of 2 minutes per transaction, 2 minutes x 5 days a week x 50 weeks = 8 hours and 20 minutes); if they expected to visit the website weekly, the yearly saving would be 1 hour and 40 minutes; and if they expected to visit the website monthly, the yearly saving would be 24 minutes.

⁷ The monetary rewards were framed in the respective local currencies. As of April 2002, one Singapore dollar = 54 US cents. Due to the currency differences, the effective ranges of monetary rewards differed between the U.S. and Singapore experiments – in US dollars, the Singapore rewards were equivalent to US\$2.70, US\$5.40, and US\$10.80, respectively.

unauthorized secondary use, and no policies to prevent improper access to information. Our conjoint analysis asked subjects to rank 18 websites (stimuli), which represented different combinations of benefits and privacy protection. In order to control for industry effects, we posed the conjoint stimuli in three settings – financial, healthcare, and travel. Within each of the three industries, we controlled for the degree of information collection by telling the subjects that all 18 stimuli (that is, hypothetical websites) requested the same set of personal information from the subjects. The personal information consisted of name, home address, phone number, e-mail address, credit card information, and some industry-specific information. In addition, travel websites requested the consumer's occupation, travel purpose, destination and frequency of travel, as well as frequent flyer numbers, healthcare websites asked for medical history, drug allergies, and prescription record, and financial websites asked for household income, stock portfolio, and previous stock trading experience.

Each subject was randomly assigned to one of the three industry settings and asked to rank the 18 stimuli (websites) according to her own preferences. In other words, the benefit/concern dimensions were within-subject factors whereas industry was a between-subject factor. To capture the background of the experimental subjects, we also included demographic questions regarding subjects' gender, age, Internet usage and previous experience with invasion of privacy.

To strengthen the external validity of our study, we conducted the conjoint experiment in both the USA and Singapore. The U.S. subjects were upper-division undergraduate students from a major Eastern university. The Singapore sample consisted of upper-division undergraduate students enrolled in an e-commerce technologies course at a major university. Table 1 presents some descriptive statistics about our subjects.

The experiment proceeded as follows. First, all subjects completed the demographic questions. Then, the experimental task and the meanings of the five dimensions were explained. Finally, the subjects ranked the 18 stimuli based on their personal preferences. In the U.S. sample, 84 participants completed the experiment, and, among them, 35 students received course credit, while the remainder were compensated with US\$7.⁸ In Singapore, 184 subjects completed the experiment and received course credit. We collected 268 responses in total.

4. Conjoint Analysis

The key outcome of conjoint analysis is the part-worths (marginal utilities) of the various dimensions that comprise the conjoint stimuli. To estimate the part-worths, we used least-squares regression with the subjects' rankings (from 1 to 18) as the dependent variable and indicators of the various levels of the two benefit and three privacy concern dimensions as the independent variables. Then, the coefficient of each independent variable would be the part-worth corresponding to that level of the dimension. Further, we calculated the relative importance of each dimension as the part-worth corresponding to the maximum level of that dimension divided by the sum of the part-worths corresponding to the maximum levels of all five dimensions. We expressed relative importance as a percentage.

Table 2 reports the means of the part-worths and relative importance for the U.S. and Singapore subjects. Note that the part-worths and relative importance for the U.S. and Singapore samples are not directly comparable as the monetary rewards were framed in the respective local currencies. At the April 2002 exchange rate, the rewards specified to the Singapore subjects were equivalent to US\$2.70, US\$5.40, and US\$10.80 respectively.

We first examined whether the responses from the subjects differed across the three industries (financial, healthcare and travel). Since our U.S. and Singapore samples were relatively large, the central-limit theorem implies that the estimated part-worths for each independent variable should approximately follow a normal distribution. Based on this premise, we conducted one-way analysis of variance (ANOVA) and pairwise t-tests to compare the part-worths across the industries. The results suggested that the part-worths (or, equivalently, the subjects' preferences) were not statistically different across financial, healthcare and travel websites. Accordingly, in all subsequent analyses, we pooled the data across industries.

The part-worths on the privacy coefficients (error, improper access, unauthorized secondary use) show strong support for Hypothesis 1. A positive part-worth for a specific privacy dimension, which differs significantly from zero, indicates that subjects on average prefer a website with this privacy feature. For example, regarding the US sample, a privacy policy which restricts improper access will rise its ranking by 3.007 (out of 18). Referring to Table 2, the part-worths for protection against all three privacy concerns were statistically

⁸ We found no statistically significant difference in part-worths between those who received course credit and those compensated

significant at the 1% level in both samples. Among U.S. subjects, the part-worth for review (which enabled an individual to correct errors in his/her personal information) was 2.968, while that for disallowing unauthorized secondary use was 2.118. Among Singapore subjects, the part-worths for error review and editing, restricting improper access, and disallowing unauthorized secondary use were 1.787, 3.374 and 4.604 respectively.

Comparing the part-worths between countries, we found that, consistent with previous research (Esrock and Ferre 1999; Milberg et al. 1995), Singapore subjects were relatively more concerned about improper access and unauthorized secondary use than errors in storing information. However, the U.S. subjects exhibited less concern for unauthorized secondary use than errors in storing information. Despite the discrepancy in relative preferences toward the different privacy protections across the two samples, our conjoint experiment confirmed previous findings that individuals are highly concerned about information privacy, and they value protective measures (Culnan and Armstrong 1999).

Our results indicate support for Hypothesis 2a; i.e., that positive reinforcements such as monetary rewards are valued. For the U.S. sample, the part-worth for a US\$20 reward was 3.141 and was statistically significant. This means that a website offering a US\$20 reward for personal information would raise its ranking by 3.141 (out of 18) as compared to an otherwise identical website offering the base level US\$5 reward. Also, the part-worth for a US\$10 reward was 1.327 and significant. For the Singapore sample, the part-worth for a S\$20 reward was 1.388 and was statistically significant. At the prevailing exchange rate, S\$20 was equivalent to US\$10.80, hence it was not surprising that the part-worth was much less than the US\$20 part-worth in the U.S. sample (3.141). Interestingly, the S\$20 part-worth among Singapore subjects (1.388) was very close to the US\$10 part-worth among U.S. subjects (1.327). This result arose even though the base-level rewards were different in the two samples (S\$5 and US\$5 respectively). The part-worth for a S\$10 reward in the Singapore sample was 0.232 but not statistically significant. Apparently, the subjects were willing to trade away privacy protection or convenience only when the monetary reward exceeded a threshold, which lay between S\$10-20 (US\$5.40 – 10.80).

Taken together, the results from the U.S. and Singapore samples suggest that a sufficiently large monetary reward did significantly increase the relative attractiveness of a

with US\$7. Hence, we pooled both groups into a single sample.

website independent of its privacy policy. Further, when the monetary reward was relatively low (as in the Singapore sample), the marginal utility of the reward was increasing, and when the monetary reward was relatively high (as in the U.S. sample), the marginal utility tended to decrease. These results indicate that the attractiveness of a monetary reward relative to privacy protection or convenience might follow the “S”-shape as shown in Figure 1. The results are consistent with economic analysis that utility functions tend to be non-concave (Friedman and Savage 1948; Hartley and Farrell 2002).

We also find a support for Hypothesis 2b; i.e., that positive reinforcements such as time saving services, operationalized by visit frequency/time savings, are valued. Referring to Table 2, in the U.S. sample, the part-worth for weekly visit was significant at the 5% level, but the part-worth for daily visit was significant only at the 10% level. Further, the part-worths for weekly and daily visits were not significantly different. In the Singapore sample, the part-worths for visit frequency/time savings were generally more significant. However, as with the U.S. subjects, the effect due to weekly visit was not significantly different from that due to daily visit.

From the results of both samples, we conclude that there is some evidence that subjects are sensitive to convenience. The evidence is stronger among Singapore subjects than U.S. subjects. Further, once the subjects expected to visit a certain website sufficiently frequently (at least once a week), more frequent visits did not seem to affect the subjects’ preferences.

The part-worths and relative importance associated with visit frequency/time savings among U.S. and Singapore subjects were very close. In both samples, these were much lower than the part-worths and relative importance for the other dimensions. Apparently, among our subjects, convenience was only a minor factor when evaluating websites. By contrast, monetary reward and privacy protection were perceived to be much more important.

We can use these results to calculate the marginal utility of a one-dollar reward. Referring to Table 2, in the U.S. sample, between the US\$5 and US\$10 rewards, the US\$5 increase raised the ranking by 1.327, or 0.265 per dollar of reward. Alternatively, between the US\$10 and US\$20 rewards, the US\$10 increase raised the ranking by $3.141 - 1.327 = 1.814$, or 0.181 per dollar of reward. These two estimates provide a range of $0.181 - 0.265$ per U.S. dollar of reward.⁹ In the Singapore sample, the S\$10 part-worth was not significantly different from zero. Accordingly, we focus on the S\$20 part-worth. Between the S\$5 and S\$20 rewards, the

S\$15 increase raised the ranking by 1.388, which amounted to 0.0925 per (Singapore) dollar of reward or 0.171 per U.S. dollar of reward. This was quite remarkably close to the range (0.181 – 0.265 per U.S. dollar of reward) that we found among U.S. subjects.

Finally, using the marginal utilities of a dollar reward and the part-worths for privacy protection, we estimate the value of protection, on a per-subject basis, for each of the three privacy concerns. Recall that we estimated the marginal utility of a US\$1 reward to be 0.181 – 0.265 among the U.S. subjects. By Table 2, the part-worth for review and editing of information was 2.968. Using the lower bound for the marginal utility (0.181 per dollar), the value of review and editing of information is $2.968/0.181 = \text{US\$}16.40$. Using the upper bound for the marginal utility (0.265 per dollar), the value is $2.968/0.265 = \$11.20$. We can use the same method to derive the values of protecting against improper access and unauthorized secondary use. The results are reported in Table 3. We also computed the values for the Singapore subjects using the marginal utility of 0.171 per U.S. dollar.

Generally, our results in Table 3 suggest that websites might need to offer substantial monetary incentives to overcome individuals' concerns about error, improper access, and unauthorized secondary use of information. Among U.S. subjects, protection against errors, improper access, and secondary use of personal information is worth US\$30.49 – 44.62.

5. Cluster Analysis

To address our secondary set of research questions – whether individuals systematically differ in their trade-off between benefits of disclosing personal information and privacy concerns, we applied cluster analysis (Green and Krieger 1991; Vriens et al. 1996). This technique groups subjects into distinct segments according to the similarity of their estimated part-worths for the various dimensions. In the present case, we apply cluster analysis to segment the subjects according to their estimated part-worths over the various benefits and dimensions of privacy protection.¹⁰

Specifically, we applied hierarchical cluster analysis using average between-group linkage with (dis)similarity measured by the squared Euclidean distance to both the U.S. and

⁹ Between the US\$20 and US\$5 rewards, the US\$15 increase raised the ranking by 3.141, or 0.210 per dollar of reward, which is within the range of 0.181 – 0.265 calculated using the other reward differences.

Singapore samples. The hierarchical method was preferred because we had no a priori information on the number of clusters and initial cluster seeds/centers (Hair et al. 1998, pp. 493 - 498). We used a distance measure for (dis)similarity as all the part-worths (the inputs to the cluster analyses) were derived from a common scale, the website rankings.

For each sample, we began the analysis with every subject constituting a separate cluster. We then examined the percentage drops in the similarity coefficient as clusters were progressively merged. In both the U.S. and Singapore samples, we stopped at three clusters as further combination of any two clusters resulted in a sharp drop in similarity, a stopping rule recommended by Hair et al. (1998, pp. 499). Table 4 reports the three clusters and the respective mean part-worths. A small number of subjects could not be classified into any of the three clusters. We excluded these observations from subsequent analysis and discussion.¹¹

Consistent across the two samples, the majority of the subjects formed a cluster that could be characterized by a high value on information privacy. Specifically, 72% of the U.S. subjects and 84% of the Singapore subjects exhibited relatively high part-worths for protection against error, improper access, and unauthorized secondary use of their personal information. By contrast, their part-worths on monetary reward and visit frequency/time savings were relatively low. We label this group of subjects as “privacy guardians” – people who attach a relatively high value to information privacy.

The next largest cluster consisted of subjects who attached a relatively high value to monetary reward. We call them “information sellers”, as they tend to “sell” personal information with little regard for convenience (visit frequency/time savings) or website privacy policies.

The smallest cluster comprised subjects who focused exclusively on convenience (operationalized by visit frequency/time savings). In fact, their part-worths for visit frequency/time savings were so high that their preferences over alternative websites could almost be predicted by visit frequency/time savings alone. We call these subjects “convenience seekers” – people who prefer convenience with little regard for money or website privacy policies.

¹⁰ In the case of monetary reward and visit frequency/time savings, we used the maximum part-worths – \$20 monetary reward and daily frequency respectively.

¹¹ Some of these outliers formed small (one- or two-member) clusters that we could not interpret. Several subjects exhibited unusual preferences such as preferring improper access to personal information. They possibly misunderstood the experimental tasks. The outliers constituted 7% and 10% of the U.S. and Singapore samples respectively.

Across the three clusters, we observe very different attitudes toward benefits and privacy. The privacy guardians prefer protection, but they still value monetary reward (the mean part-worth for monetary reward was significantly different from zero). Only the convenience seekers value convenience; for all other clusters, the part-worths for visit frequency/time savings were insignificant.¹² Among the three privacy concerns, only unauthorized secondary use was significant in all three clusters.

Based on opinion surveys, Westin (2001, pp. 16) characterized 12% of the U.S. population as being “privacy unconcerned”: “for 5 cents off, they will give you any information you want about their family, their lifestyle, their travel plans, and so forth”. Interestingly, we found that 12.5% of the U.S. sample were “information sellers”. However, our evidence is that information sellers demand a great deal more than “5 cents off.” Indeed, this point distinguishes our analysis from opinion surveys: we can estimate the dollar amount that information sellers must be paid for their information.

Further, our analysis revealed a cluster that Westin (2001) did not identify. This cluster consisted of convenience seekers, people who would “sell” their personal information for convenience rather than money. Finally, among the remainder of the U.S. population, Westin (2001) differentiated between “privacy pragmatists” (63%) and “privacy fundamentalists” (25%) according to their sensitivities to privacy, while our cluster analysis did not find such a distinction. We did detect some evidence among the U.S. subjects that the privacy guardians could be further segmented, with each sub-segment placing relatively greater weight on one of the three privacy concerns.

Having identified three clusters, we investigated whether cluster membership depended systematically on particular demographic variables. We first sought systematic differences between information sellers and privacy guardians. Among the U.S. subjects, we found that information sellers had significantly more prior experience of providing personal information to websites than privacy guardians ($t = 3.115$, $p < 0.01$). The information sellers’ greater prior experience was consistent with their relatively high part-worths for money. However, among the Singapore subjects, there was no significant difference between information sellers and privacy guardians in terms of prior experience of providing personal information to websites.

¹² Interestingly, our finding that the subjects were sensitive to convenience seems to be due solely to the convenience seekers.

We next investigated systematic differences between convenience seekers and privacy guardians. Among the U.S. subjects, convenience seekers were much more accepting of cookies than privacy guardians ($t = 4.282$, $p < 0.001$). Specifically, the convenience seekers were less concerned about cookies, and they typically accepted all cookie manipulations from websites without warning. By contrast, the majority of the privacy guardians requested to be warned about cookies. Many of them even configured their browsers to reject all cookies. The convenience seekers' greater acceptance of cookies was consistent with their relatively high part-worths for visit frequency/time savings.

Among the Singapore subjects, the convenience seekers were also less concerned about the use of cookies than the privacy guardians ($t = 6.954$, $p < 0.001$). This result was consistent with the preferences of the U.S. sample.

Overall, we found some evidence that information sellers had more prior experience of information provision than privacy guardians, and strong evidence that convenience seekers were more accepting of cookies than privacy guardians.

6. Policy and Business Implications

We now address the key public policy issue – whether the benefit of increased privacy regulation justifies the cost. In the United States, the national cost of complying with various legislative proposals to increase regulation of online privacy has been estimated to be US\$9-36 billion (Hahn 2001).

Referring to Table 3, we estimate that, on average, each individual values protection against errors, improper access, and secondary use of personal information at between US\$30.49 – 44.62. In March 2001, an estimated 58 million Americans made a purchase over the Internet (Horrigan and Rainie 2002). Based on the number of purchasers, we estimate the benefit of privacy protection to be US\$1.77 – 2.59 billion, which falls quite far short of Hahn's (2001) cost estimates.¹³ This estimate is conservative, hence understates the value of privacy protection for several reasons. Stronger privacy legislation might raise consumer participation in Internet commerce, hence generating additional benefit. Further, our calculation assumes that each

¹³ If each person values privacy at US\$30.49, then 58 million persons would value privacy at a total of $58 \times 30.49 = \text{US\$}1,768$ million or approximately US\$ 1.77 billion. Similarly, if we use the higher estimate of the value of privacy (US\$44.62), the value of privacy to the entire population is US\$2.59 billion.

consumer provides information to just one website. To the extent that they provide information to multiple websites, the value of privacy protection would be greater.

Our results also address another public-policy issue – the viability of proposals to regulate privacy through markets (Laudon 1996; Varian 1997). Given that individuals' concern for privacy is not absolute, but rather can be traded off against benefits such as money and convenience, we conclude that market solutions may well be viable.

As for business implications, we identified three distinct segments – privacy guardians, information sellers, and convenience seekers – in terms of individual trade-offs between the benefits of disclosing personal information and privacy concerns. The immediate implication is that e-commerce providers must differentiate their services to serve these distinct segments. Just as an auto manufacturer makes differentiated models for various segments, an e-commerce provider must differentiate its services to best meet the needs of segments with differing trade-offs among money, convenience, and privacy concerns.

Convenience seekers will be the first to register with a website if it simplifies web site navigation or enables personalized content. Businesses can exploit this by offering them the opportunity to provide personal information to customize the web site and simplify the shopping experience.

Information sellers are distinguished from privacy guardians by prior experience of information provision. This customer type cannot be lured to provide personal information by offering them convenience. To the extent that businesses cannot observe a consumer's prior experience, they must use indirect methods to induce segmentation by self-selection (Bhargava and Choudhary 2002; Moorthy 1984; Png 2002, Chapter 9). Businesses could use monetary rewards to attract information sellers to provide personal information. Preferably, businesses would seek convenience seekers first before enticing information sellers.

By elimination, the consumers who do not respond to either monetary reward or convenience would be privacy guardians. Businesses would need to use other strategies, such as privacy seals (Benassi 1999) or procedural fairness (Culnan and Armstrong 1999), to persuade these consumers to provide their personal information.

7. Concluding Remarks

By applying conjoint analysis, we have shown that individuals' preferences over disclosing personal information to websites do systematically vary with monetary reward and convenience. Further, we provided the first analysis of the benefit vis-à-vis cost of increased privacy regulation in the United States. In addition, we identified three distinct segments in terms of individual trade-off between the benefits of disclosing personal information and privacy concerns – privacy guardians, information sellers, and convenience seekers. Finally, we made some headway in characterizing these segments.

Our findings are subject to a number of limitations which are common to many experimental settings. All of our subjects were undergraduate students. They would be younger and probably be more familiar with the Internet and e-commerce than the general consumer population. Further, they may have had relatively little experience of medical problems, relatively little travel experience, and had too little wealth to be familiar with investment opportunities and risks. This might explain why we found no systematic industry differences in subjects' preferences.¹⁴ For all these reasons, it would be important to verify our findings with a more representative sample of subjects.

We tested our hypotheses using experimental data collected from Singapore and U.S. subjects, which include students from diverse countries and cultures. Although our results are remarkably consistent across the two samples, future work could explore the possible influences of cultural values on individuals' preferences for privacy and positive reinforcements. Previously, using Hofstede's (1991) cross-cultural value indices, Milberg et al. (2000) find that privacy concern is positively related to power distance, individualism and masculinity, and negatively related to uncertainty avoidance. We do not have a priori information or checking on the cultural values of our subjects. Therefore, it is infeasible for us to interpret our results in light of cultural differences. It would be interesting for future research to extend our findings and introduce cultural factors when studying decisions involving privacy trade-offs.

Further, the reported part-worths are sensitive to the specified attribute levels. For example, our conjoint stimuli specified only two levels of each privacy concern – no protection and protection. In reality, however, businesses have more flexibility. For example, they may

state that personal information is currently not used for secondary purposes, but that such a practice cannot be ruled out in the future. Similarly, rewards may range from cash or vouchers to lottery drawings. Different reward structures may imply different estimates for the marginal utility of a one-dollar reward. Future research may attempt to measure the impact of privacy policies and reward structures more directly.¹⁵

¹⁴ By contrast, Westin (2001) reported that Americans were particularly sensitive to privacy over financial and health information.

¹⁵ However, this may require a willingness of the businesses to share the kind of data that they have promised not to share for secondary use.

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Table 1: Descriptive Statistics

	U.S.	Singapore
Number of subjects	84	184
Percentage of females	42%	44%
Average age	24	23.1
Average Internet experience (years)	6.8	5.9
Percentage of subjects having online purchase experience	95%	61%
Subjects' country of origin (number of subjects)	U.S. (48), India (13), 10 other countries (each less than 5)	Singapore (145), Malaysia (12), 9 other countries (each less than 5)

Table 2. Part-Worths and Relative Importance

Instruments	Level	U.S.		Singapore	
		Part-Worth ⁺	Relative Importance	Part-Worth ⁺	Relative Importance
Monetary Reward	\$5 [#]	0	26.24%	0	11.69%
	\$10 [#]	1.327 ^{***} (0.341)		0.232 (0.165)	
	\$20 [#]	3.141 ^{***} (0.534)		1.388 ^{***} (0.281)	
Visit Frequency/Time Savings	Monthly	0	6.13%	0	6.02%
	Weekly	0.568 ^{**} (0.260)		0.432 ^{***} (0.153)	
	Daily	0.734 [*] (0.411)		0.715 ^{***} (0.254)	
Error	No Review	0	24.80%	0	15.06%
	Review	2.968 ^{***} (0.355)		1.787 ^{***} (0.194)	
Improper Access	No restriction	0	25.12%	0	28.43%
	Restriction	3.007 ^{***} (0.529)		3.374 ^{***} (0.349)	
Unauthorized Secondary Use	Allowed	0	17.70%	0	38.80%
	Not allowed	2.118 ^{***} (0.324)		4.605 ^{***} (0.297)	

⁺ Standard errors in parentheses. The control stimulus consisted of the lowest levels of each of the included dimensions. Because the control was represented by a least squares intercept, we label all lowest level part-worths as zero. The mean intercept is not reported for brevity.

[#] US dollars for U.S. subjects and Singapore dollars for Singapore subjects.

*** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Table 3: Value of Privacy (in U.S. dollars)

Website privacy policy	Value	
	U.S.	Singapore
Review for error	\$11.18 - 16.36	\$10.45
Restriction against improper access	\$11.33 - 16.58	\$19.73
Secondary use not allowed	\$ 7.98 - 11.68	\$26.93

Table 4: Clusters

Segment (no. of observations)		Average part-worth				
		Monetary reward	Visit Frequency/ Time Savings	Error	Unauthorized Secondary Use	Improper Access
U.S. (78) +	Privacy guardians (56)	1.637*** (0.385)	0.027 (0.316)	4.040*** (0.434)	2.576*** (0.448)	5.116*** (0.519)
	Information sellers (16)	10.865*** (0.330)	-0.781 (0.753)	0.245 (0.458)	1.255** (0.483)	-0.099 (0.462)
	Convenience seekers (6)	1.445 (0.781)	11.028*** (0.613)	1.500** (0.348)	0.750* (0.371)	0.542 (0.945)
Number of outliers/unclassifiable observations: 6						
Singapore (165) +	Privacy guardians (138)	0.464** (0.195)	0.089 (0.166)	2.234*** (0.183)	5.734*** (0.318)	4.973*** (0.314)
	Information sellers (14)	11.286*** (0.360)	-0.714 (0.855)	0.107 (0.263)	1.768*** (0.434)	0.446 (0.470)
	Convenience seekers (13)	1.127 (0.862)	10.512*** (0.682)	0.404 (0.372)	1.077** (0.484)	0.173 (0.382)
Number of outliers/unclassifiable observations: 19						

⁺ Number excluding outliers.

*** significant at 1% level; ** significant at 5% level; * significant at 10% level.

Standard errors in parentheses.

Figure 1: Part-Worths for Monetary Reward